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09/649,013	08/28/2000	Yasukazu Nihei	Q58716	7581

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EXAMINER	
ANGEBRANNDT, MARTIN J	
ART UNIT	PAPER NUMBER
1756	

DATE MAILED: 02/04/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/649,013	NIHEI ET AL.	
	Examiner	Art Unit	
	Martin J Angebranndt	1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11/19/03, 11/24/03* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *2-12 and 19-21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *2-12 and 19-21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

1. The response of the applicant has been read and given careful consideration. Responses to the arguments offered by the applicant are presented after the first rejection to which they are directed. The examiner notes that a number of the foreign references previously cited are not equivalents to the US references of the amendment of 2/27/2003 to pages 35-36. This is not considered essential subject matter as the subject matter contained in these references is not recited in the claims and therefore is not new matter. The applicant should be aware that the deletion of the these references may be considered a forswearing of the subject matter contained within them through prosecution estoppel. The rejection under 35 U.S.C. 112, first paragraph is withdrawn based upon the evidence of record concerning the references. The cancellation of claim 1, which detailed lift off processes for forming electrodes obviates the rejectionsd under 35 USC 102.

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 2,7, 8 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Miyawaki et al. '750 or Byer et al. '221, in view of Kanarian et al. '068.

Miyawaki et al. '750 teach the coating of a lithium niobate crystal with a positive photoresist, which is contact exposed with a comb electrode pattern is disclosed. After development, Al is deposited on the patterned resist and acetone used in the lift-off process to remove the resist and overlying aluminum to form the comb electrodes. (7/32-60). The examiner

notes that contact exposure results in the near field exposure (14/19-15/3) as the pattern is in direct contact with the resist.

Byer et al. '221 teach the coating of a lithium niobate crystal with a positive photoresist, which is contact exposed with a comb electrode pattern is disclosed. After development, Cr is deposited on the patterned resist. (12/25-48). The formation of periods of 15.5 micron with 3.5 micron metal lines is disclosed. (10/54-57).

Kanarian et al. '068 states that the lithium niobate may be used as the waveguiding medium with NLO response. (3/44-52). The coating of the Al electrode materials on the substrate, the overcoating of this with a photoresist and contact exposure of the resist with 405 nm light is disclosed. The resist pattern is then transferred to the aluminum by etching, followed by removal of the resist.

It would have been obvious to one skilled in the art to modify the processes of either Miyawaki et al. '750 or Byer et al. '221 by using the metalization, resist processing and etching process taught by Kanarian et al. '068 for the same function with a reasonable expectation of achieving comparable results.

The applicant attempts to dismiss the teachings of etching to produce the comb/ grating electrode patterns in the waveguide arts. The Kanarian et al. '068 is within the same field of endeavor and even discloses the use of lithium niobate, the same materials as either Miyawaki et al. '750 or Byer et al. '221. Therefore the disclosed of an alternative methods to form the electrode within the same field of endeavor is held to be a disclosure of equivalence. Although it is discussed in the prior art section as undesirable, this seems to refer to just bulk crystals, in

view of the teachings in column 3 of the utility of lithium niobate in the invention. The rejection stands.

The applicant has argued that a domain reversal is not disclosed in the prior art. The specification indicate sthat the application of a field with respect to the electrode will facilitate a domain reversal. (page 3/lines 7-17), therefore the use of the electrode neccesarily results in selected domain inversion. This is also disclosed in cited text in Byer et al. col. 13/lines 1-7, therefore the position is factually incorrect. The examiner also points out that frequency doubling could not occur in the absence of the domain reversal. The applicant argues that one of ordinary skill in the art would not turn to Thompson and Saito. The examiner holds that these are in a related field of endeavor and in particular Thompson is a general teaching in the photolithographic arts which points to the benefits of multilayered resists. The pitch of 0.6 taught in Yamanouchi et al. meets the 0.3 microns limitation and the Taguchi et al reference teaches periods of 1-30 microns which embraces the recited limitation. The issue of coating a metal electrode material and etching it is described in the rejection citing Kanarian et al '068 and is clearly not allowable for the reasons of record.

4 Claims 2,7-9 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Miyawaki et al. '750 or Byer et al. '221, in view of Kanarian et al. '068 and Hosaka et al. JP 08-179493.

Hosaka et al. JP 08-179493 (machine translation attached) discloses the use of contact masking processes where the light is coupled into the mask through a prism. See figures. The EBANNESSENTO (evanescent) light exposure uses the light more efficiently and results in increase fineness in the features which can be formed. [0006,0011 & 0017] The use of light of

460 nm is below is disclosed [0019]. The use of a pure phase masking process is shown in figure 8

It would have been obvious to one skilled in the art to modify the process of either Miyawaki et al. '750 or Byer et al. '221 combined with Kanarian et al. '068 by using the masking process of Hosaka et al. JP 08-179493 to more efficiently use the light and increase the resolution.

The applicant states that the secondary references do not teach near field exposure on page 12 of the response. The examiner disagrees, noting that the teqchings of the evanecent light exposure clearly indicates that this is a near field exposure process and the ability to exceeed the diffraction limit would have been clear motivation to one of ordinary skill in the art to use this exposure technique based purely upon increased resolution. This is not divergent from the teachings of either Miyawaki et al. '750 or Byer et al. '221 as either process would be expected to benefit from the increased resolution. The convex/concave nature of the surface recited in claim 9 is shown in figure 8 of the Hosaka et al. JP 08-179493 reference and was not ignored by the examiner.

Claims 2,7,8,10 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Miyawaki et al. '750 or Byer et al. '221, in view of Kanarian et al. '068 and DeFornel et al. '464.

DeFornel et al. '464 teaches the use of a light on a fiber optic probe which allows for scanning exposure of the resist without contacting the resist. The resolution is below 100 nm when 400 nm light is used. (4/9-42) The use of 300 nm light is also disclosed. (8/60-63)

It would have been obvious to one skilled in the art to modify the process of either Miyawaki et al. '750 or Byer et al. '221 combined with Kanarian et al. '068 by using the exposure process of DeFornel et al. '464 to gain the benefits of increased resolution and reduced contact with the resist.

The examiner points out that near field exposure is disclosed and that the feature size is disclosed as 100 nm (4/16-17), while the exposure wavelength is disclosed as 400 nm (4/34-36). Clearly, to acheive 100 nm features, the aperture of the fiber tip must be that size, otherwise the feature would be larger.

6 Claims 2-8 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Miyawaki et al. '750 or Byer et al. '221, in view of Kanarian et al. '068, Thompson, L.F., et al., "Introduction to Microlithography", pp. 288-335 (1983) and Saigo et al. '576.

Thompson, L.F., et al., "Introduction to Microlithography", pp. 288-335 (1983), describe multilayer resist systems and their benefits. These include high resolution, higher aspect ratio, which translate to improved image transfer during etching, fewer depth of focus, topographical and interference effects. (290-294). The use of these systems in lift-off processing is disclosed (301-305). The use of RIE processing of bilayer resist is disclosed (309-310).

Saigo et al. '576 teach the use of resist bilayers where the topmost resist contains silicon. The topmost silicon containing resist is sensitive to UV and resistant to etch processes and the use of a two layer process increases resolution. (1/8-25 and 2/60-3/4). As only two layers are used, the process is simplified over three layer systems. (5/33-39).

It would have been obvious to one skilled in the art to one skilled in the art to modify the invention of either Miyawaki et al. '750 or Byer et al. '221 combined with Kanarian et al. '068 by

using bilayer resist processes such as those taught by Thompson, L.F., et al., "Introduction to Microlithography", pp. 288-335 (1983) and Saigo et al. '576 with a reasonable expectation of gaining the advantages in resolution, pattern transfer accuracy and reduced problems with interference effects and topography.

The rejection stands for the same reasons as provided above, as no further arguments were directed at this rejection.

7 Claims 2-9 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Miyawaki et al. '750 or Byer et al. '221, in view of Kanarian et al. '068, Hosaka et al. JP 08-179493, Thompson, L.F., et al., "Introduction to Microlithography", pp. 288-335 (1983) and Saigo et al. '576.

It would have been obvious to one skilled in the art to one skilled in the art to modify the invention of either Miyawaki et al. '750 or Byer et al. '221 combined with Kanarian et al. '068 and Hosaka et al. JP 08-179493 by using bilayer resist processes such as those taught by Thompson, L.F., et al., "Introduction to Microlithography", pp. 288-335 (1983) and Saigo et al. '576 with a reasonable expectation of gaining the advantages in resolution, pattern transfer accuracy and reduced problems with interference effects and topography.

The rejection stands for the same reasons as provided above, as no further arguments were directed at this rejection.

8 Claims 2-8,10 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Miyawaki et al. '750 or Byer et al. '221, in view of Kanarian et al. '068, DeFornel et al. '464, Thompson, L.F., et al., "Introduction to Microlithography", pp. 288-335 (1983) and Saigo et al. '576.

It would have been obvious to one skilled in the art to one skilled in the art to modify the invention of either Miyawaki et al. '750 or Byer et al. '221 combined with Kanarian et al. '068 and DeFornel et al. '464 by using bilayer resist processes such as those taught by Thompson, L.F., et al., "Introduction to Microlithography", pp. 288-335 (1983) and Saigo et al. '576 with a reasonable expectation of gaining the advantages in resolution, pattern transfer accuracy and reduced problems with interference effects and topography.

The rejection stands for the same reasons as provided above, as no further arguments were directed at this rejection.

9 Claims 2-8,11 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Miyawaki et al. '750 or Byer et al. '221, in view of Kanarian et al. '068, Thompson, L.F., et al., "Introduction to Microlithography", pp. 288-335 (1983) and Saigo et al. '576, further in view of Harada et al. '308.

Harada et al. '308 teaches magnesium oxide doped lithium niobate with electrodes formed photolithographically to have a period of 4 microns. (example 1). The use of MgO-LN is recognized in the art as preferred, particularly due to higher damage threshold. (1/4-52)

It would have been obvious to one skilled in the art to modify the process of either Miyawaki et al. '750 or Byer et al. '221 alone or combined with Kanarian et al. '068, Thompson, L.F., et al., "Introduction to Microlithography", pp. 288-335 (1983) and Saigo et al. '576 by using the MgO doped lithium niobate as taught by Harada et al. '308 with a reasonable expectation of gaining the benefit of increased damage threshold in the resultant article.

The rejection stands for the same reasons as provided above, as no further arguments were directed at this rejection.

10 Claims 2-8,11-12 and 19-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Miyawaki et al. '750 or Byer et al. '221, in view of Kanarian et al. '068, Thompson, L.F., et al., "Introduction to Microlithography", pp. 288-335 (1983) and Saigo et al. '576, further in view of Harada et al. '308, Taguchi et al. JP 04-335620 and Yamanouchi et al. '197.

Taguchi et al. JP 04-335620 teaches periods of 1-30 microns and electrode widths of 0.5-15 microns. Periods of 10 and 2 microns are disclosed with lithium niobate materials. The electrode line width is the spacing between the electrodes as disclosed with respect to figure 1D as element 12a of the instant specification.

Yamanouchi et al. '197 teaches in embodiment 3, the formation of electrodes with a pitch of 0.6 microns on a lithium niobate substrate using conventional lithographic processing.

In addition to the basis provided above, the examiner holds that it would have been obvious to modify the invention of either Miyawaki et al. '750 or Byer et al. '221, combined with Kanarian et al. '068, Thompson, L.F., et al., "Introduction to Microlithography", pp. 288-335 (1983), Saigo et al. '576 and Harada et al. '308 by using electrodes with spacings of less than 0.3 microns as taught by Taguchi et al. JP 04-335620 and Yamanouchi et al. '197 to render it useful with shorter wavelengths.

The rejection stands for the same reasons as provided above, as no further arguments were directed at this rejection.

11 Any inquiry concerning this communication or earlier communications from the examiner should be directed to Martin J Angebranndt whose telephone number is 571-272-1378. The examiner can normally be reached on Monday-Thursday and alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9309 for regular communications and 703-872-9309 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Martin J Angebranndt
Primary Examiner
Art Unit 1756

January 29, 2004